Testing for Citrus Virus Diseases in the Philippines

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ALTHOUGH a number of citrus species and citrus relatives are native to the Philippines, citrus production there is inadequate to meet the demand of the local market. Virus diseases are a major factor in limiting production of citrus fruits in the country. To overcome this problem, the Lipa Citrus Experiment Station, with the technical assistance of the Food and Agriculture Organization of the United Nations, started a program to identify and control citrus virus diseases. This paper reports the results obtained under the joint program.

Present Status of Virus and Virus-Like Diseases

As the first step, a survey was conducted to determine the incidence of virus diseases and virus-like disorders. One hundred and five citrus orchards in the main citrus areas of the country were inspected for symptoms of virus diseases. The number of trees in each orchard ranged from about 100 to 55,000. From ten to 100 trees in each orchard were examined for disease symptoms. The incidence of tristeza, psorosis, xyloporosis, and exocortis in trees of different citrus varieties was noted. Attention was also given to the occurrence of a virus disease named leaf-mottling disease.

Results of Field Observation

Tristeza stem pitting was found in many citrus varieties. Most severely affected were the trees of certain Washington navel selections, Mindanao Suret orange No. 1 and Igorot sweet oranges [*Citrus sinensis* (L.) Osb.], Marsh seedless grapefruit (*C. paradisi* Macf.), Seville lemon and Rough lemon [*C. limon* (L.) Burm. f.], calamondin (*C. reticulata* var. *austera* x *Fortunella* sp.), and Tizon (*C. papillaris* Blanco). All sweet orange trees showed some degree of stem pitting. Pitting was not observed on trees of mandarin (*C. reticulata* Blanco), certain pummelo [*C. grandis* (L.) Osb.] varieties, and Eureka or Lisbon lemons.

Xyloporosis symptoms were observed in most orchards where the trees were seven or more years old, but only on mandarin scions or rootstocks. Symptoms were found on Szinkom, Ladu, Szwuikom, Sunwuikom, Batangas, and Jolo mandarins. Approximately 30 to 40 per cent of the Szinkom mandarin and 20 to 30 per cent of the Ladu mandarin trees over ten years old exhibited xyloporosis. Also, trees of several varieties of sweet orange and Marsh grapefruit were found to be carriers of xyloporosis virus.

Leaf symptoms of psorosis were frequently observed in trees of Szinkom and Ladu mandarin, Pineapple and Valencia oranges, and Marsh grapefruit. However, psorosis trunk symptoms were rare. Psorosis bark scaling was observed in some Szinkom mandarin trees over 15 years of age in the Batangas and Bicol areas. Blind pocket and concave-gum symptoms were also found in a few trees of this variety.

Exocortis was observed in a small number of trees of Ladu and Szinkom mandarins, growing on a rootstock identified as Kusaie lime (*C. reticulata* var. *austera* hyb.). Trees on other rootstocks may be carrying the exocortis virus, but being tolerant, do not express symptoms.

Leaf-mottling disease was found within an 80 to 100 kilometer radius of Lipa City and in one orchard in Oriental Mindoro (6). Field observations indicate that this disease is spreading rapidly in the area, and it is estimated that several hundred thousand trees have already been destroyed by the disease.

Other virus-like problems encountered include the following: bud-union crease, sweet orange phloem discoloration, Tahiti lime bark disease, Sunwuikom mandarin bark scaling, variola, and zonate chlorosis. Trees with symptoms resembling podagra (2) and stubborn were also found.

Indexing Methods

One hundred and ninety-four outstanding citrus trees, 7 to 20 years old, representing practically all the commercial citrus varieties grown in different areas of the Philippines, were selected for indexing. Forty-one are nucellar seedlings. Buds from different branches of each tree were brought to the Lipa Experiment Station and worked on indicator plants. The indicator varieties used are as follows: Hinkley sweet orange for psorosis, Rangpur lime and Etrog citron [*C. medica* (L.) var. *ethrog* Engl.] for exocortis, Orlando tangelo (*C. reticulata* x *C. paradisi*) for xyloporosis, and Key lime [*C. aurantifolia* (Christm.) Swing.] for tristeza. Certain trees were also tested on Eureka lemon and sour orange for seedling-yellows symptoms. Indexing for exocortis, psorosis, and xyloporosis was conducted in the field through use of the support method (3, 4) in which seedlings of Calamandarin (*C. reticulata* hyb.) were inoculated with blind buds from the tree to be tested and subsequently budded above, with a healthy nucellar bud of the indicator variety. Three inoculation buds were used for each seedling and three seedlings were used to index each tree. Key lime seedlings in the screenhouse were used for indexing for tristeza.

Results of the Indexing Program

As indicated by symptoms on test plants of Key lime, tristeza was found in all trees indexed, except a few lemon trees. Inoculum from most trees induced seedling-yellows symptoms on the proper indicators.

Indexing for psorosis and exocortis viruses is still in progress. However, after six months we found that 30.1 per cent of the selected trees were infected with the psorosis virus and 23.8 per cent carried exocortis virus. Trees of the following varieties have shown no psorosis or exocortis symptoms to date: Oneco, Sunwuikom, Szinkom x Ladu, Kalinga, Gayonan, Ladu x Szibat, Satsuma and Tankan mandarins, Ram Lau Chiang and three other local sweet orange varieties, Lisbon and Seville lemons, calamondin, Malvar tizon, and some other miscellaneous varieties. Testing for xyloporosis is underway but requires a much longer period. No results are available yet.

A large number of studies were conducted regarding leaf-mottling disease. Indexing for this virus disease was conducted initially on young budlings of Szinkom mandarin on Calamandarin rootstock. Later, young seedlings of Szwuikom mandarin were used. In this indexing program, only selected trees in the leaf-mottle-infected area were tested for this virus. Some trees of Szinkom and Ladu mandarins and all trees of Tan-

kan mandarin were found infected. The results are summarized in another paper in these proceedings (6).

Discussion and Conclusions

Previous surveys (1, 7) were restricted to small areas. This survey reports a widespread occurrence of citrus virus diseases in the Philippines, which is confirmed by the indexing program.

Intolerant rootstocks are seldom used in the Philippines, consequently, losses from tristeza are confined to those varieties having partially intolerant tissues. However, strains of tristeza virus more severe than those reported from North and South America appear to be present in the Philippines, and their wide distribution may have the harmful effect of shortening the life of citrus trees. Psorosis is not a serious problem possibly because trees older than 20 years are rare in the country. However, by reducing the vigor and productivity of a large percentage of trees, xyloporosis is responsible for great losses, although selection of healthy mother trees may eliminate it from future plantings. Exocortis is not a problem at present, but may become one if intolerant rootstocks, like Rangpur lime or trifoliata and some of its hybrids, become widely used.

Leaf-mottling disease presents the most serious threat to the Philippine citrus industry. This disease seems to be spreading rapidly and has already destroyed several hundred thousand citrus trees (5, 6).

On the basis of the work reported in this paper, a Citrus Budwood Certification Program was launched for the selection of outstanding virus-free trees to serve as sources of healthy budwood for citrus growers of the Philippines.

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